4th. Aluminium castings are not affected by chilling. Graphite is liberated whether the casting is cooled rapidly or slowly, with the result that the grain is uniform and there is no chill.

5th. When sufficient aluminium is present to liberate the graphite, a coating is formed on the casting which resists the sand and the heat, and prevents the iron burning the sand into itself.

6th. The fineness of the grain causes them to be more easily cut than cast iron of coarser grain.

7th. The presence of aluminium increases the strength to sustain a constant load, but the strength does not increase uniformly with the percentage of aluminium.

8th. The increase in strength is much greater and more marked than in the preceding. Above a certain percentage the strength diminishes, due to larger amount of graphite liberated.

9th. Elasticity is improved.

10th. The fineness and compactness of iron containing aluminium gives less permanent set than iron equally as soft when that softness is produced by *silicon*.

11th. The shrinkage is slightly increased with a small quantity of aluminium, due probably to the elimination of blowholes, but with 0·75 per cent. and more it is much decreased, especially in case of the wrought iron.

12th. In case of the white iron fluidity is much increased. With grey base containing much silicon it is not so clear, though it is believed *the fluidity is increased*.

The fact that aluminium lowers the melting point of iron is utilised in the Mitis castings, the invention of Mr. Peter Ostberg, of Stockholm. In making Mitis castings, a very small quantity of aluminium, about ·050 per cent. Al, in form of 7 or 8 per cent. ferro-aluminium is added to the charge (about 60 lb.) of wrought iron in the crucible the moment this has been melted. The fusing point is at once lowered about 500°, and the charge becomes very fluid and can be cast in the finest moulds, while the great difference between its temperature and its fusing point gives all the *time necessary* for its manufacture without danger of its solidifying.

The tensile strength of Mitis castings may be as high as 27 tons per square inch, with an elongation of 20 per cent. Another alloy made in *the electric furnace is silicon bronze*, which, owing to its great strength and tenacity, its resistance to corrosion, combined with high electrical conductivity, is perhaps the best metal extant for electric light, telephone, and telegraph wires.

In conclusion, may I direct your attention to the test bars, castings, and specimens of aluminium alloys made by the Cowles process, kindly lent for this paper by the Cowles Syndicate Company, Limited.

Specimens of Aluminium Alloys made in Cowles' Process. Exhibited in connexion with Paper read before "B" Section, British Association.

No. 1. Aluminium bronze cylinder (torpedo shell).—2 feet long, 14 inches diameter; cast in sand with core, outside finely polished; inside rough. Test bars taken from same pouring gave: Tensile strength, 105,000 lb. per square inch (46·87 tons); elongation, 6 per cent.

No. 2. Cylinder same as above, made from aluminium brass "No. 2" (one-third zinc) (33·3 per cent.).—Tensile strength, 90,000 lb. per square inch (40·17 tons); elastic limit, 66,000 lb. per square inch (29·46 tons); elongation, 6 per cent.

No. 3. Piece of calico-printing cylinder, 6 inch diameter and about 1 foot long. Cast by Messrs. Bolton and Sons, *Oakamoor* Mills, Cheadle, Staffordshire, in the same manner as they cast their copper cylinders.

No. 4. Dynamo hub of aluminium brass "No. 2."—This metal has a tensile strength of 93,000 lb. to the square inch, and 5 per cent. elongation. The German silver that has heretofore been used in the Brush hubs has but 44,000 lb. tensile strength, and 24 per cent. elongation, and costs much more than this brass.

No. 5. Billet of 10 per cent. aluminium bronze cast in chill.—One entire side polished to show perfect casting, colour, &c.

No. 6. Lathe turnings of aluminium bronze, showing no signs of oxidation after three years' exposure to the atmosphere.

No. 7. Aluminium "pig" casting (80 per cent. aluminium).—Produced directly by heat of electric furnace reduction of oxide of aluminium by carbon. (Believed to be the first reduction by carbon of this oxide.)

No. 8. North Metropolitan (London) Tramways Company's "car bearing" of ordinary gun-metal after a year's wear, and originally of same dimensions as No. 9.

No. 9. Same company's car bearing made from Cowles' aluminium bearing metal after a year's running on same route as No. 8, no wear being perceptible.

No. 10. Aluminium bronze bar, one end hammered hot, other end twisted cold.

No. 11. Five per cent. aluminium bronze bar.—Bending test, bent cold.

No. 12. Ten per cent. aluminium bronze rolled sheet.—Test, spring by bending.

No. 13. Five per cent. aluminium bronze rolled bar. Tested at Phœnix Works, Ruhort, Germany. — Tensile strength, 82,880 lb. to square inch (37 tons); elongation, 60 per cent.

No. 14. Five per cent. aluminium bronze cup drawn cold from a 9-inch disc.

No. 15. Sample of silicon copper product run direct from furnace. Silicon = 15·08 per cent.

No. 16. Bar of basic Siemens steel, tested at Phœnix Works, Ruhort, Germany, showing bending and fracture.

No. 17. Bar of 10 per cent. Cowles' aluminium bronze, tested at Phœnix Works, Ruhort, Germany, showing bending and fracture.

No. 18. One-inch round bar of aluminium bronze.

No. 19. Two-inch square bar of aluminium.

No. 20. Propeller blade of No. 2 aluminium brass.

No. 21. Ores, slags, and fragments of carbons from the electric furnace.

No. 22. Drawings and views of the furnace, engine, and dynamo.

No. 23. Photographs of the "Cowles'" aluminium works, Milton, Staffordshire.

A NOTE ON THE VOLATILISATION OF LEAD OXIDE, AND ITS ACTION UPON GLASS AT LOW TEMPERATURES.

A Paper read before the British Association, Newcastle-on-Tyne, September 1889.

BY T. W. HOGG.

Lead oxide in a state of fusion attacks silica with great readiness, and by merely exposing a mixture of these substances to a red heat for some time combination will take place without the mixture having been in a state of fusion; it is therefore not surprising to find that glass should be acted upon by lead oxide at a comparatively speaking low temperature.

If a polished plate of glass be coated with oxide of lead and then heated up to a temperature of scarcely visible redness, or even slightly below this, it will be found, after cooling and removing the surplus oxide, that the surface has been distinctly corroded, owing to the oxide having entered into combination with the constituents of the glass. The corroded parts produced by conducting the operation at this temperature possess quite a smooth surface, but if the corrosion be allowed to take place at a decided red heat the parts are rough and not unlike the effect produced by dry hydrofluoric acid. By soaking these corroded plates in a solution of ammonium sulphide the lead may be converted into sulphide of lead, and the corrosion may be so varied under different conditions that brilliant mirror-like films may be obtained of considerable durability and of sufficient thickness to be quite opaque, or so thin that light of a brownish hue is transmitted.

Upon examining these corroded parts under the microscope the limit of each mark was observed to possess a delicate fringe easily seen by very oblique light, and especially if the glass was observed from the reverse side, the appearance being similar to what might be produced by a slightly volatile substance. Whilst submitting this point to a more careful examination it was found that if a plate of glass was written upon, using lead oxide as a pigment, and another plate, preferably of some dark blue or ruby tinted glass, placed immediately over it but prevented from actual contact by suitable means—if these were then heated for about one hour to a temperature of scarcely visible redness, the upper glass always had its polish so altered that a distinct reverse of the writing appeared upon it, more or less sharp according to the distance between the two surfaces.

It was suspected at first that this result was produced by the mechanical transportation of particles of the oxide, as the expulsion of moisture from moist substances is often accompanied by the expulsion of part of the substance itself. This suspicion, however, was easily disposed of by previously heating the oxide before placing the upper glass over it; the effects were just as easily obtained with this precaution, and quite a conclusive experiment consists in actually fusing the oxide upon a platinum support; if this is then covered by a plate of glass and prevented from actual contact in the usual way, and heated to the usual temperature, the polish of the glass will also be distinctly altered. The effects are also obtained if a little lead oxide be placed in a platinum crucible and this covered by a piece of dark blue glass; in this case it requires exposure to the low temperature for two or three hours before the glass is tarnished. It is generally understood that lead oxide is not sensibly volatile below its fusing point, and so far as the indications of the balance are concerned this may be quite true; it is therefore very interesting to know that by the experiments here described, it can be shown that lead oxide volatilises at a scarcely visible red heat in such quantities that fail to be recognised by the most sensitive balance.

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ON SOME RESULTS OF ANALYSES OF OLIVE OIL FROM DIFFERENT SOURCES.

BY LEONARD ARCHBUTT.

The examination at various times during the past seven or eight years of samples taken from large bulks of olive oil intended for lubricating has afforded an opportunity of making a comparison of the oil from several different sources; but as, unfortunately, only a fraction of the samples have been labelled with the port of shipment, the number available for purposes of comparison is not so large as it might have been.

The results are arranged in the following table, and the following conclusions may be drawn from them:—

Source of the Oils.	Total Number of Samples.	Number Examined for Adulteration as well as for Acidity.	Number found Genuine.	Per Cent. found Genuine.	Free Fatty Acid (= Oleic Acid).		
					Highest.	Lowest.	Average.
Seville..........................	32	32	31	96·8	10·0	1·5	4·4
Malaga..........................	35	35	27	77·1	25·1	2·0	6·7
Unknown..........................	3	3	2	66·6	5·6	2·1	3·3
Spain (total)................	70	70	60	85·7	25·1	1·5	5·5
Gallipoli..........................	19	18	17	94·4	16·9	·9	7·3
Gioja..........................	12	8	8	100·0	25·2	4·1	10·9
Monopoli..........................	3	3	3	100·0	8·6	4·1	6·3
Naples..........................	2	1	1	100·0	9·4	9·2	9·3
Italy (total)................	30	30	29	96·7	25·2	·9	8·5
Sicily (Messina)	28	22	9	40·9	16·6	·5	9·1
Greece (Zante)	2	2	2	100·0	8·7	4·8	6·7
Candia..........................	12	10	6	60·0	16·8	5·5	9·5
Levant..........................	3	3	..	..	13·5	8·5	10·4

The Seville oils, both as regards their freedom from acidity and the high percentage of genuine samples among them, prove to be superior to the famed Gallipoli oils. The acidity of some of the samples of Malaga oil was very high, but the average acidity was less than that of any of the Italian oils, except those from Monopoli, of which only three samples were examined. Among the Malaga oils there was a large percentage of adulterated samples. Taking the Spanish oils generally, although they appear from these results to be more liable than the Italian oils to be adulterated, yet, on the other hand, they are as a rule decidedly more neutral, which, as regards lubrication and burning, is a very important point.

Amongst the Italian oils those from Gioja are distinguished for their acidity. *The small number of adulterated* Italian oils is worthy of note.

My analyses of the oils from Sicily quite confirms their reputation for inferiority. They are very largely adulterated, and as a rule decidedly rancid.

A few single samples from sources not named in the table have also been examined. Thus, some oil from Mitylene proved to contain as much as 30 per cent. of free fatty acid.